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TENUIPTERIA GEULEMENSIS (MOLLUSCA : BIVALVIA), AN INOCERAMID SPECIES FROM THE UPPER MAASTRICHTIAN OF THE SINT PIETERSBERG AREA, THE NETHERLANDS

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ABSTRACT

The inoceramid species *Tenuipteria geulemensis* (F. VOGEL, 1895) is recorded for the first time from the Upper Maastrichtian (*Belemnella junior* and *B. casimirovensis* Zones) in the Maastrichtian type area (Sint Pietersberg, Maastricht, The Netherlands). It can be used as an index fossil for the Upper Maastrichtian in northern and eastern Europe, and is very similar to the North American Maastrichtian species *T. argentea* (CONRAD).

RÉSUMÉ

Tenuipteria geulemensis (F. VOGEL, 1895) est une espèce d'inocérame non encore signalée dans le Maastrichtien supérieur (zone à *Belemnella junior* et zone à *B. casimirovensis*) de la région type de l'étage (Montagne Saint Pierre près de Maastricht, Pays-Bas). Elle peut être employée comme fossile guide dans les dépôts du Maastrichtien supérieur d'Europe du Nord et de l'Est ; elle est très proche de l'espèce maastrichtienne nordaméricaine *T. argentea* (CONRAD).

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INTRODUCTION

The Maastrichtian, uppermost stage of the Cretaceous has yielded in its type area a very rich fauna known at least since the 18th century.

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The fauna from the Maastrichtian type area — the Sint Pietersberg — was listed by J. BOSQUET (1860). Since then no-one has attempted so comprehensive a task, but many groups have been monographically studied (e.g. Ammonites, A. de GROSSOUVRE [1908] ; Gastropods, F. KAUNHOWEN [1897] ; Foraminifera, B. J. ROMEIN [1962] and J. HOFKER [1966] ; Echinoids, J. LAMBERT [1911], J. SMISER [1935], M. MEIJER [1965] ; Ostracods, G. DEROO [1966] ; Bryozoans, E. VOIGT [1953] ; « Calcisphaerulidae », J. M. VILLAIN [1975]). The Bivalves were studied by F. VOGEL (1895), who based his work on the collections of the universities at Bonn (G.F.R.), Leiden (The Netherlands) and Liège (Belgium). Later work has been published on the Rudists (W. A. E. VAN DE GEIJN, 1940) and on the Pectinids (A. V. DHONDT, 1971, 1972a, b, 1973a, b, 1976). I have lately undertaken the study of the other Pteriomorphia from the Maastrichtian type area ; these include an « inoceramid » species from the Maastrichtian « tufkrijt » (= Maastrichtien sensu DUMONT, 1849 = Maastricht Formation of W. M. FELDER, 1975).

In BOSQUET's list no *Inoceramus* species is listed as occurring in the « Maastrichtsch Krijt » (= Maastricht Formation), or the Upper Maastrichtian in the international sense (Zone of *Belemnella junior* and Zone of *B. casimirovensis*).

I have mainly studied the material from the collections of the K.B.I.N. - I.R.Sc.N.B. : the « old » collections : BOSQUET, UBAGHS, NYST, CORNET, etc., collections more recently acquired such as the M. MEIJER collection, and the vast amount of material collected by bulk sampling along and in the Albert Canal in the 1930's under M. GLIBERT and in 1955 under L. VAN DE POEL. Among this material (at a rough estimate Pteriomorphs number at least 75.000 specimens) is one species not previously cited from the Maastrichtian type area ; this is a « borderline » inoceramid, *Tenuipteria geulemensis* (F. VOGEL, 1895), recorded under different names from the Upper Maastrichtian in most northern and eastern European deposits of the temperate realm.

CLASSIS BIVALVIA

SUBCLASSIS PTERIOMORPHIA
Superfamilia Pteriacea
Familia *Inoceramidae*

Tenuipteria STEPHENSON, 1955
(emended diagnosis in I. G. SPEDEN, 1970, p. 23)

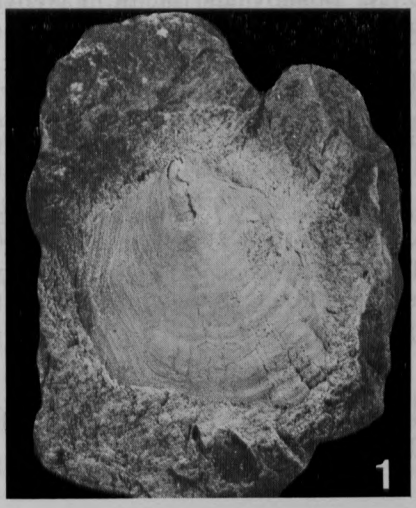
Tenuipteria geulemensis (F. VOGEL, 1895)

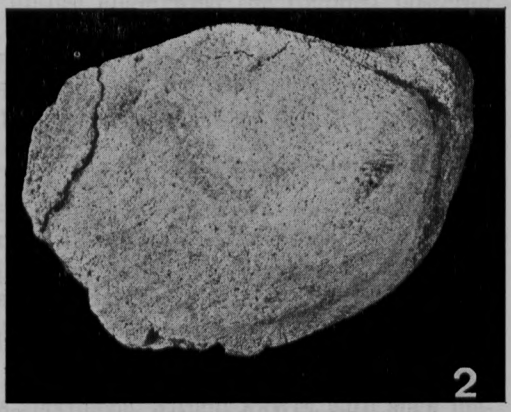
. 1895 *Avicula Geulemensis* nov. sp. — F. VOGEL, pp. 28-29, pl. 2, figs. 3-6 ;
. 1902 *Avicula* spec. — J. P. J. RAVN, p. 81, pl. 1, figs. 4-5 ;

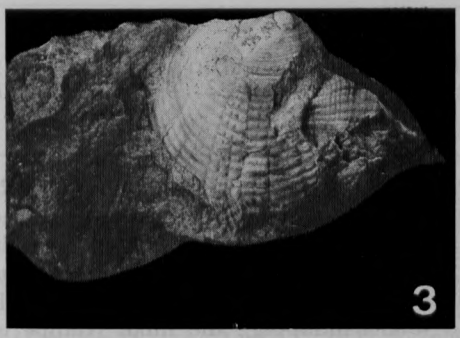
PLATE I

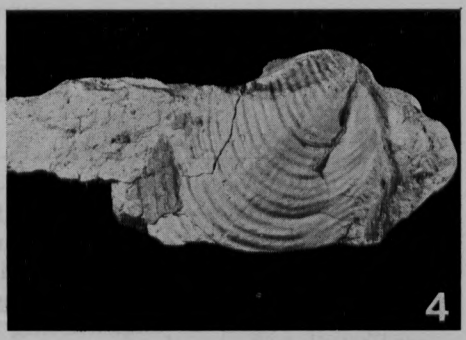
Fig. 1 : right valve, × 2, Kunrader Limestone, Kunrade, Zuid-Limburg (T.C.M.I. 10165) ;
Fig. 2 : double steinkern, right valve on top, × 1.25, Maastrichts Tufkrijt, Sint Pietersberg, Maastricht, Coll. Bosquet (T.C.M.I. 10166) ;
Fig. 3 : right valve, × 1, Kunrader Limestone, Kunrade, Zuid-Limburg (T.C.M.I. 10167) ;
Fig. 4 : left valve, × 1, *B. junior* Zone, Hemmoor, Schleswig-Holstein, G.F.R. (Niedersächsisches Landesamt für Bodenforschung) ;
Fig. 5 : interior of right valve, × 1, Maastrichts Tufkrijt ; Sint Pietersberg, Maastricht, Coll. Bosquet (T.C.M.I. 10168) ;
Fig. 6 : interior of right valve, × 2, Maastrichts Tufkrijt, Sint Pietersberg, Maastricht, Coll. Bosquet (T.C.M.I. 10169).

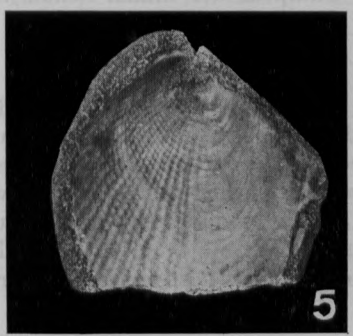
PLATE I











p.p. 1922 *Inoceramus tegulatus*	— H. Ødum, pp. 1-13, figs. 1, 2, 3, 7 ;
. 1959 *Inoceramus tegulatus*	— S. A. Dobrov and M. M. Pavlova, pp. 150-151, pl. 23, figs. 1-4 ;
1959 « *Inoceramus tegulatus* » Ødum	— O. Seitz, p. 124 ;
. 1965 *Inoceramus dobrovi* n. sp.	— J. A. Jeletzky, pp. 955-956 ;
1969 *Spyridoceramus tegulatus*	— L. R. Cox in Moore, p. N 320, figs. C 48 3a-b ;
. 1970 *Tenuipteria dobrovi*	— I. G. Speden, p. 34, pl. 2, figs. 4-6.

non 1842 *Inoceramus tegulatus* F. von Hagenow, nec 1922 *I. tegulatus* H. Ødum, figs. 4, 5, 6, nec 1932 *I. tegulatus* D. Wolansky, nec 1956 *I. tegulatus* O. Seitz, p. 4, nec 1961 *I. tegulatus* O. Seitz, pp. 123-124, nec 1965 *I. tegulatus* J. A. Jeletzky, p. 955, nec 1968 *I. tegulatus* S. P. Kotsyubinski, p. 148, pl. 28, fig. 3, pl. 29. fig. 8, nec 1970 *Tenuipteria tegulata* I. G. Speden, pp. 6-8, pl. 2, figs. 1, 2, 3.

Type specimen :

As lectotype I chose the specimen figured in F. Vogel, pl. II, fig. 4, in the Rijksmuseum voor Geologie in Leiden (The Netherlands).

Type locality :

« Geulem » (Geulhem in modern spelling, Limburg, The Netherlands).

Geological Horizon :

« Obere Mucronatenkreide » (in Geulhem : Mc-Md of Uhlenbroeck, 1912, Upper Maastricht Formation of Felder, 1975).

Original description (Vogel, 1895, p. 28)

Von dieser Muschel ist meistens die äussere Schalschicht erhalten ; dieselbe liegt jedoch dem Gestein so fest auf, dass sie kaum abzulösen ist. Die Steinkerne, welche sich mehrfach finden, geben nur ein undeutliches Bild der Muschel, da die Ohren stets abgebrochen sind, und sie dadurch das Aussehen einer *Pholadomya* erhalten. Nur wo eine isolierte Klappe einen Steinkern hinterliess, ist dieser vollständig. Die Schale ist ungleichseitig und ungleichklappig ; die linke Klappe ist stark gewölbt, mit weit überragendem Wirbel, die rechte nur schwach gewölbt ; vorn ein kleines, hinten ein sehr grosses und breites Ohr. Der grade Schlossrand bildet mit dem ebenfalls graden Vorderrand einen beinah rechten und mit dem gebogenen Hinterrand einen stumpfen Winkel. Der Stirnrand ist gebogen.

Der Mittelteil der Schale ist geziert mit etwa 20 flachen und breiten, radialen Rippen, welche von concentrischen gekreuzt werden. Das hintere Ohr zeigt nur die concentrischen Rippen und radiale Streifung. Die Skulptur der linken Schale ist weniger kräftig als die der rechten.

Translation of the original description :

Only the external shell layer of this bivalve is preserved ; it is so strongly attached to the sediment that it cannot be loosened. Internal moulds are numerous but give an incomplete impression of the bivalve, because the ears are always broken off and thus the specimen looks like a *Pholadomya*. Only when an isolated valve has become a Steinkern will this be complete. The shell is inequilateral and inequivalve ; the left valve is very inflated with a strongly projecting umbo and weakly inflated right valve. At the anterior side is a small ear ; at the posterior side a very

large and wide ear. The straight dorsal margin forms with the straight anterior margin an almost right angle, and an obtuse angle with the rounded posterior margin. The pallial margin is rounded.

The central part of the shell is ornamented with 20 flattened, wide plicae, crossed by concentric folds. The posterior auricle bears only concentric ribs and radial striation. The ornamentation of the left valve is not so pronounced as that of the right valve.

Additional description :

Material studied :

Geulhem : 2 steinkerns of left valves, 2 steinkerns of right valves, 1 left and 1 right valve with shell material ;

Sint Pietersberg : 5 steinkerns of left valves, 5 steinkerns of right valves, 1 left and 4 right valves with shell material ;

Kunrade : 2 steinkerns of double valves specimens, 3 right valves with shell material ;

Houthalen (in coal pits) : 2 incomplete left valves with shell material.

Measurements (in mm.)

1. U.P.D.	2. W.	Ratio 1/2	3. dorsal margin	Ratio 1/3	4. plicae	5. side	locality
87	74.4	1.29	54	1.61	18	L	Geulhem
63	48	1.31	37.4	1.68	—	L	»
52.4	39.7	1.32	27.2	1.32	—	L	»
45.3	37.2	1.22	23.4	1.22	—	L	»
29.4	27.2	1.08	16.4	1.67	19	R	»
41.2	33	1.24	18.6	2.22	—	L	Sint Pietersberg
37.2	34.8	1.07	—	—	22	R	»
52.2	36	1.45	26.2	1.99	—	L	»
46.3	35.4	1.30	20	2.32	—	R	»
45.8	35.4	1.29	24.0	1.91	—	L	»
40.5	35	1.16	—	—	—	R	»
28	26.5	1.06	—	—	18	L	» Md
20	—	—	—	—	17	L	» Mc
27.4	22.4	1.25	17.6	1.56	—	R	»
38.2	31.7	1.21	27.8	1.37	24	R	»
39.6	—	—	—	—	26	R	»
31	—	—	—	—	19	R	»
20	—	—	—	—	17	L	»
42.2	35.4	1.19	22	1.92	27	R	Kunrade
24.8	—	—	14.8	1.68	—	R	»
16.2	—	—	—	—	—	R	»
27	—	—	—	—	21	R	»
28.2	—	—	—	—	22	R	»

Abbreviations used :

U.P.D. : umbo-pallial diameter : distance from the umbo to the pallial margin, perpendicular to the dorsal margin ;

W. : the longest distance from the anterior to the posterior side of the disc perpendicular to its U.P.D. ;

P.D.M. : posterior dorsal margin : distance from the umbo to the end of the margin at the dorsal extension of the disc ;

L : left ; R : right.

DESCRIPTION

Inequivalve, medium-sized (U.P.D. 16-90 mm, n = 23) species with inequilateral valves with prosogyrate umbones.

Right valve : rarely flattened, generally moderately inflated, the umbo projecting (2 to 4 mm) above the dorsal (= hinge) margin ; anterior auricle triangular and small (auricle Hmax = 6 mm, W = 5.5 mm on a specimen with U.P.D. = 42.2 mm) ; posterior extension of the valve broad ; W. varies from 22.4 mm to 35.4 mm (n = 7), U.P.D./W. varies from 1.07 to 1.30.

Left valve : inflated, with a wide projecting umbo (5 to 9 mm) above the dorsal margin ; anterior auricle as on the right valve ; W. varies from 26.5 to 74.4 mm (n = 8), U.P.D./W. varies from 1.06 to 1.45 ; postero-dorsal margin straight, 14.8 to 54 mm (n = 13) long, U.P.D./P.D.M. varies from 1.37 to 2.32.

The available material suggests that right valves are somewhat smaller than left valves : average U.P.D./W. for right valves is 1.18, whereas for left valves it is 1.27.

Both valves are covered with the same ornamentation : a combination of radial and concentric plicae which seems to be slightly more pronounced on right than on left valves ; on some specimens the radial plicae are of equal development, but on others, each alternating interspace is somewhat deeper ; where concentric and radial plication are of similar strength the sculpture seems to consist of small juxtaposed squares separated by narrow radial and concentric furrows.

Right valves :

Number of plicae counted at the ventral margin :

plicae :	19	19	21	22	22	24	26	27
U.P.D. in mm	29.4	31	27	28.2	37.2	38.2	39.6	42.2

The radial plication does not cover the complete shell ; on the posterior part of the valve only one-third to two-fifths bears concentric ornamentation ; at the anterior side, the radial plication reaches the side margin. Three right valves (from Kunrade) have a more pronounced concentric than radial ornamentation and two only a slight radial plication.

Left valves :

Number of plicae counted at the ventral margin :

plicae :	17	18	19
U.P.D. in mm :	20	28	90

Only one of the valves shows a well developed plication and it seems to cover the whole valve ; it reaches the anterior margin and it almost reaches the posterior margin.

COMPARISON AND SYNONYMY

The description and figures given by F. VOGEL for « *Avicula geulemensis* » are perfectly adequate, but have been totally ignored by later authors. The species was not recognised as an inoceramid by VOGEL because of the very thin, incomplete shell and because of the total absence of ligamental areas on the specimens he studied. The general shape and the ornamentation of the specimens from Limburg are identical with the material described and figured by H. ØDUM, 1922 (figs. 1, 2 3, 7 non figs. 4, 5, 6) ; the Danish specimens were proved by I. G. SPEDEN 1970 to be identical with those described as *Inoceramus tegulatus* by S. A. DOBROV and M. M. PAVLOVA, 1959 and for which J. A. JELETZKY created the name *Inoceramus dobrovi*. JELETZKY's name thus becomes a junior subjective synonym of « *Inoceramus* » *geulemensis* (VOGEL). L. R. COX in MOORE, 1969 used the name of the Lower Maastrichtian species (= *Inoceramus tegulatus* F. von HAGENOW, 1842) from Rügen, but copied ØDUM's description and those of his figures which apply to the Upper Maastrichtian inequivalve species.

I. G. SPEDEN, 1970 gave a detailed discussion of the inoceramid species belonging to the genus *Tenuipteria* from N. America and Europe, and clearly stated the differences between *T. tegulata* (von HAGENOW) and *T. dobrovi* (JELETZKY) (= *T. geulemensis*). The *Tenuipteria* group has a wider geographical distribution than stated by I. G. SPEDEN. M. A. PERGAMENT, 1974 (pp. 192-193, pl. 45, figs. 5, 6, pl. 46, fig. 1) described *Inoceramus kusiroensis* NAGAO et MATSUMOTO, 1940 from the Maastrichtian of Kamchatka and Japan and stated this species to be close to « *Inoceramus tegulatus* s.l. ».

Among the specimens of *Tenuipteria geulemensis* from Limburg is one left valve with an almost complete hinge : the specimen is unfortunately not well enough preserved to be figured but is very close to pl. 3, fig. 3 of I. G. SPEDEN (*T. argentea* [Conrad]). Without seeing specimens of *T. argentea* I cannot decide on whether *T. geulemensis* and *T. argentea* are synonymous ; the ornamentation, the general shape, the hinge appear almost identical but the measurements seem to be different ; this could be due to the methods used, but at present no conclusion can be drawn.

Biogeographical and stratigraphical distribution :

Restricted to the Upper Maastrichtian (*B. junior* Zone and *B. casimirovensis* Zone) of Limburg (Belgium and the Netherlands), Hemmoor (Schleswig-Holstein, G.F.R. — only *B. junior* Zone), Denmark (ØDUM, 1922, SPEDEN, 1970 — Upper Maastrichtian), Caucasus and Crimea (DOBROV and PAVLOVA, 1959 and personal communication of M. A. PERGAMENT, April 1978 — Upper Maastrichtian).

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